

COCONUT BASED HIGH DENSITY MULTISPECIES CROPPING SYSTEM UNDER DIFFERENT LEVELS OF FERTILIZERS IN RED SANDY LOAM SOILS

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ABSTRACT

Coconut based HDMSCS model consisting of clove (112 plants/ha), banana (345 plants/ha) and pineapple (2250 plants/ha) was studied under full, two-third, one-third, one-fourth, one-fifth of recommended fertilizers of crops as per the package of practices for productivity and economic viability for four consecutive years (1995-96 to 1998-99) at CPCRI, Kasaragod.

The data on mean productivity of crops revealed that the yield levels have declined with reduction of fertilizers below the one-third of recommended dose in the system. The coconut yield did not vary much among one-third, two-third and full dose of recommended fertilizers (147 to 152 nuts/palm/year). However, fertilizer levels below one-third dose recorded a mean nut yield of 124 to 133 nuts/palm/year. The component crops viz. clove, pineapple and banana performed better under two-third and full dose of recommended fertilizers in the system. The clove have not flowered under control and one-fifth dose in some years. The banana bunch weight was 5.12 and 5.54 kg under two-third and full dose an increase of 54.7% and 67.4% respectively over control. Pineapple also recorded an increase of 23.2% and 27.1% fruit weight respectively over control. The total cost for the system was Rs. 29,127/ha under absolute fertilizer control plot, increased by 3.9%, 4%, 4.8%, 11.6% and 18% under one-fifth, one-fourth, one-third, two-third and full dose of fertilizers, respectively. The net income was maximum with two-third of fertilizers (Rs. 75,375/ha) followed by full (Rs. 69,798/ha), one-third (Rs. 64,781/ha), one-fourth (Rs. 58,535/ha) and control (Rs. 50,618/ha). This indicates that the system is more economically viable at two-third of recommended fertilizers of individual crops.

Key words: High density planting, Coconut based mixed cropping, clove, Banana, Pineapple, Economics.

INTRODUCTION

Coconut is primarily a small holders plantation crop in India. About 80 per cent of the coconut holdings in the country are either small or marginal and the average holding size is around 0.22 ha. The income derived from such small holdings is insufficient to sustain even the small families. Besides, a crop of coconut at a recommended spacing of 7.5 x 7.5 m does not fully utilize the available soil and air space and incident solar radiation (Gopalasundaram *et al.*, 1993). Adoption of coconut based inter/mixed cropping systems is one of the ways to overcome these problems. However, growing a single crop as inter/mixed crop in coconut garden would not

utilize the resources like, land, moisture, sunshine *etc.*, to the full extent possible. This has led to the concept of High Density Multispecies Cropping System (HDMSCS), where number of compatible crops grown in a unit area to meet the diverse needs of the farmer such as food, fuel, timber, fodder and cash, and are ideally suited for smaller units of land and aim maximum production per unit area of land, time and inputs with minimum or no deterioration of land (Bavappa and Jacob, 1982; Bavappa *et al.*, 1986). Such practice of growing more crops in a unit land area would add lot of biomass to the soil in the form of leaf sheddings, prunings *etc* and indirect addition of nutrients to the system. This makes

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it necessary to rationalise the fertilizer recommendations of crops in the system. Pushpa Kumari and Sasidhar (1992) reported that the fertilizer recommendation can be reduced to half of the recommended dose to amorphophallus when intercropped in coconut. The results of coconut based HDMSCS model studied under full, two-third and one-third of recommended fertilizers for ten years at Kasaragod showed no marked yield difference of crops among the treatments (Anon. 1995). This suggests the scope of further scaling down of recommended fertilizers of crops in the system. Hence, this study evaluates the coconut based HDMSCS under six different levels of fertilizers for productivity and economic variability in red sandy loam soil.

MATERIALS AND METHODS

A HDMSCS model was established in 1.2 ha of 18 year old West Coast Tall (WCT) coconut plantation spaced 8 x 8 m during 1983 by interplanting 17 additional crops in Central Plantation Crops Research Institute farm at Kasaragod. The experimental site is located at about sea level on the West coast and receives an annual rainfall of 3500 mm. The soil is deep red sandy loam (*Arenic Paleustult*). The model was studied under three levels of recommended fertilizers of crops (one-third, two-third and full) upto 1993. The annual crops, except banana were withdrawn from the system in stages as the perennial crop grew and utilised more space and sunlight. Some perennials also were removed from the system as their performance was not satisfactory. By 1994, only three component crops such as clove, banana (Kadali) and pineapple (Kew) were left in the system. The layout plan, plant population and their adopted spacings are given in Fig. 1.

During 1994 the model was subdivided into six plots and studied under six levels of fertilizers by including one-fifth, one-fourth of recommended fertilizers and control treatments to the earlier treatments. The recommended dose of fertilizers adopted was 500g N: 320g P₂O₅: 1200g K₂O/plant/year for coconut, 200g N: 200g P₂O₅: 400g K₂O/plant/year for banana, 300g N: 250g P₂O₅:

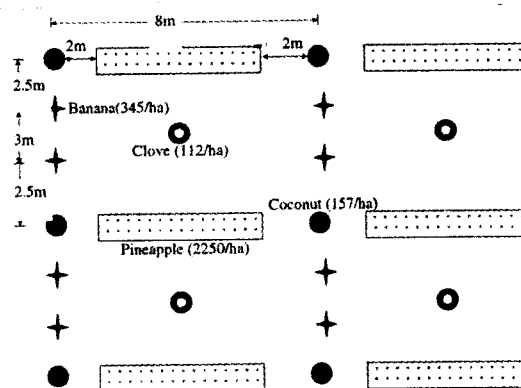


Fig. 1. Plan and layout of coconut based HDMSCS model.

750g K₂O/tree/year for clove and 8gN: 4g P₂O₅:12g K₂O/plant/year for pineapple and applied in two splits for all crops during June and September months. Urea, rockphosphate and muriate of potash were used as the source of NPK. Other intercultivation and plant protection measures were taken up as per the requirement. Banana and pineapple were replanted once in every three years. The system was perfo irrigated @ 20 mm once in a week during summer months. Input and output details were recorded for each treatment separately at regular intervals from 1995 to 1999. All the calculations were performed for one hectare. The market rate for both inputs and outputs for the current year was considered to workout the economics of the system.

RESULTS AND DISCUSSION

Productivity of crops under fertilizer levels: The productivity of all the crops in the system are given in Table-1. The coconut yield ranged from 133 nuts/palm/year to 165 nuts/palm/year due to fertilizer treatments during 1995-96. The nut yield did not vary much (159-165 nuts/) among one-third, two-third and full dose of recommended fertilizers. However, with reduction in fertilizers below one-third of recommended dose, the nut yield declined sharply in coconut. The nut yield in control treatment varied from 149 nuts/palm/year in 1995-96 to 117, 130, 126 nuts/palm/year in 1996-97, 1997-98 and 1998-99 respectively. This inter year variation in nut yield

Table 1. Productivity of crops under different levels of fertilizers in coconut based HDMSCS

Sl No.	Treatments/Crops	1995-96	1996-97	1997-98	1998-99	Mean
1	Control					
	Coconut(Nuts/palm)	149	117	130	126	131
	Clove (g/tree)	137	253	-	-	98
	Pineapple (g/fruit)	599	480	570	930	645
	Banana (kg/bunch)	3.56	1.78	3.40	4.50	3.31
2	One-fifth					
	Coconut(Nuts/palm)	137	110	133	117	124
	Clove (g/tree)	280	408	-	220	227
	Pineapple (g/fruit)	564	520	740	1000	706
	Banana (kg/bunch)	3.38	1.98	2.63	4.80	3.20
3	One-fourth					
	Coconut(Nuts/palm)	133	113	154	130	133
	Clove (g/tree)	223	730	207	150	328
	Pineapple (g/fruit)	716	600	700	1000	754
	Banana (kg/bunch)	4.42	3.57	2.58	5.10	3.92
4	One-third					
	Coconut(Nuts/palm)	165	130	158	136	147
	Clove (g/tree)	472	434	200	-	277
	Pineapple (g/fruit)	606	580	660	980	707
	Banana (kg/bunch)	4.43	3.90	3.14	6.70	4.54
5	Two-third					
	Coconut(Nuts/palm)	159	140	170	139	152
	Clove (g/tree)	452	943	318	770	621
	Pineapple (g/fruit)	610	720	870	980	795
	Banana (kg/bunch)	4.51	5.22	4.04	6.70	5.12
6	Full					
	Coconut(Nuts/palm)	163	137	155	143	150
	Clove (g/tree)	225	690	279	480	419
	Pineapple (g/fruit)	719	680	900	980	820
	Banana (kg/bunch)	5.51	5.32	4.24	7.10	5.54

was due to the climatic variations. Even in fertilizer treatments this inter year variation in nut yield was noticed (Table 1). The component crop, clove performed better under two-third and full dose of recommended fertilizer in all the years. After three years of introduction of lower doses of fertilizers, the clove trees have not even flowered under control and one-fifth dose of fertilizers in 1997-98. In 1998-99 also, clove trees in control and one-third dose of fertilizer treatments did not flower. The pineapple fruit weight did not show any consistent trend due to fertilizer treatments in all the years. However, the mean weight of fruit for four years was better under two-third (795 g/fruit) and full dose (820 g/

fruit) of recommended fertilizers compared to the rest of treatments.

The bunch weight of banana was superior under two-third and full dose of recommended fertilizers in all the years. The bunch weight ranged between 1.78 to 4.5 kg/bunch during 1995-99 under control treatment and increased to 1.98 to 4.80 kg/bunch, 2.58 to 5.10 kg/bunch, 3.14 to 6.70 kg/bunch, 4.04 to 6.70 kg/bunch and 4.24 to 7.10 kg/bunch with application of fertilizers @ of one-fifth, one-fourth, one-third, two-third and full dose of recommended fertilizers respectively during 1995-99 period.

The data on mean productivity of crops revealed that the yield levels have declined with

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reduction of fertilizers below one-third of recommended dose in the system. The coconut yield did not vary much among one-third, two-third and full dose of recommended fertilizers (147 to 152 nuts/palm/year). However, fertilizer levels below one-third dose recorded a mean nut yield of 124 to 133 nuts/palm/year. The clove have not flowered under control and one-fifth dose in some years. The banana bunch weight was 5.12 and 5.54 kg under two-third and full dose an increase of 54.7% and 67.4%

respectively over control. Pineapple also recorded an increase of 23.2% and 27.1% fruit weight respectively over control.

The mean nut yield per hectare among the fertilizer treatments ranged from 18949 to 22982, (Table 2). The nut yield did not vary much among one-third (22226/ha.), two-third (22984/ha) and full (22680/ha) dose of recommended fertilizers. However, with reduction in fertilizer below one-third dose, the nut yield declined to 20110/ha under one-fourth, 18749 nuts/ha under one-fifth and

Table 2. Mean production and economic returns (Rs/ha) in coconut based HDMSCS

Sl No.	Treatments/Crops	Mean production /ha (1995-96 to 1998-99)	Cost of Cultivation (Rs/ha)	Gross returns (Rs/ha)	Net profit (Rs/ha)
1	Control		29127	79745	50618
	Coconut (nuts/ha)	19807		59421	
	Clove (kg/ha)	10.51		2102	(25.4%)
	Pineapple (kg/ha)	1393		8358	
	Banana (kg/ha)	1096		9864	
2	One-fifth		30255	79797	49542
	Coconut	18749		56247	
	Clove	24.30		4860	(29.5%)
	Pineapple	1525		9150	
	Banana	1060		9540	
3	One-fourth		30291	88826	58535
	Coconut	20110		60330	
	Clove	35.20		7040	(32.1%)
	Pineapple	1629		9774	
	Banana	1298		11682	
4	One-third		30535	95316	64781
	Coconut	22226		66678	
	Clove	29.70		5940	(30%)
	Pineapple	1527		9162	
	Banana	1504		13536	
5	Two-third		32507	107832	75325
	Coconut	22982		68946	
	Clove	66.60		13320	(36%)
	Pineapple	1717		10302	
	Banana	1696		15264	
6	Full	34363	104161	69798	
	Coconut	22680		68040	
	Clove	44.90		8980	(34.6%)
	Pineapple	1771		10626	
	Banana	1835		16515	

(Figures in paranthesis are per cent contribution of component crops towards gross returns) Market price of crops produce: Coconut Rs3/nut; Clove Rs 200/kg; Pineapple Rs 6/kg; Banana Rs 9/kg.

19807nuts/ha under absolute fertilizer control. The component crops *viz.* clove, pineapple and banana performed better under two-third and full dose of recommended fertilizers in the system. The results of this model studied under three levels of recommended fertilizers for ten years also indicated no marked yield difference of crops in the full and two-third levels of recommended fertilizers (Anon. 1995).

ECONOMICS

Cost of cultivation: The cost of cultivation for one hectare of HDMSCS model consisting of coconut, clove, banana and pineapple among the fertilizer levels ranged from Rs.29127/ha/year to 34363/ha/year as per prevailing market prices of all inputs during current year (Table 2). The total cost for the model was Rs. 29,127/ha under absolute fertilizer control plot, increased by 3.9%, 4%, 4.8%, 11.6% and 18% under one-fifth, one-fourth, one-third, two-third and full dose of fertilizers, respectively. This variation in cost of cultivation among the treatments was solely due to variation in total cost of fertilizers. The total cost for the model which was about Rs 16100/ha during 1983-84, increased to about Rs 18610/ha during 1989-90 and further to Rs 40570/ha in 1996-97 under full dose of recommended fertilizers (Sairam *et al.*, 1999)

Gross returns: The gross returns derived from one hectare model under each treatment was worked out considering the prevailing current market prices of crop produces (mean yield). The gross returns varied from Rs.79745/ha/year under control to Rs.107832/ha/year under two-third dose of recommended fertilizers. The gross returns were slightly lower under full dose (Rs 104161/ha/year) and one-third dose (Rs 95316/ha) as compared to two-third dose. With reduction in fertilizers below one-third, the gross returns also declined sharply to Rs.88826/ha/year under one-fourth, Rs.79797/ha/year under one-fifth and Rs.79747/ha/year under absolute fertilizer control. Consequently the net returns were also lower under fertilizer doses below one-third at Rs.58537/ha/year under one-fourth, Rs.49542/ha/year under one-fifth and Rs.50618 under control treatment. The net income was maximum with two-third of fertilizers (Rs. 75,375/ha) followed

by full (Rs. 69,798/ha), one-third (Rs. 64,781/ha), one-fourth (Rs. 58,535/ha) and control (Rs. 50,618/ha). This indicates that the system is more economically viable at two-third of recommended fertilizers of individual crops. The total returns from the system was only Rs 14350/ha during 1983-84, increased to Rs 66170/ha during 1989-90 and further to Rs 132800/ha under full dose of fertilizers in 1996-97, in which the share of coconut to the total returns was more than 80 per cent (Sairam *et al.*, 1999). The gross profit of the system which was Rs -1750/ha during 1983-84, had increased to Rs 47560/ha in 1989-90 and further to Rs 92230/ha in 1996-97. This inter year variation in gross profit was mainly due to changes in coconut prices.

Although the returns are predominantly from coconut, it is to be noted that banana and pineapple also contributed substantially, particularly with application of full (Rs 16515/ha/year-banana and Rs.10626/ha/year-pineapple) and two-third dose of fertilizers (Rs.15264/ha/year-banana and Rs.10302/ha/year-pineapple). The contribution of component crops towards gross income was only Rs 25.4% in control has increased to 29.5%, 32.1%, 30%, 36% and 34.6% with application of fertilizers at one-fifth, one-fourth, one-third, two-third and full dose of recommended fertilizers respectively. The yield of clove has not yet stabilized. In the event of good stabilized yield in clove, the returns would be higher with fertilizer applications. The study suggests that growing of these crops with coconut maintaining a high density planting in the system provides gainful employment and also helps to realize stabilized returns. This is every much evident in this case, even with lower market price of coconut in the present situation, the system as a whole could provide reasonable returns. The cash flow analysis performed (Sairam *et al.*, 1999) also obtained highly positive values of discounted incremental benefit for both full and two-third dose of recommended fertilizers.

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